

No. 1458

HALL OF THE FRANKLIN INSTITUTE,

Philadelphia,

Jan 20 1890.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, to whom was referred for examination

The Hollerith Electric Tabulating System.

Report that:

The Hollerith Electric Tabulating System is a device ~~for~~ by which electricity is applied to the compilation and tabulation of census and other returns of a similar nature which require summation and classification under various heads and in different groups.

"The method consists ^{essentially} ~~essentially~~ ~~highly~~ in first recording the data relating to each person by punching holes in sheets or strips of electrically non-conducting material (paper), and then counting or tallying these data either separately or in combination by means of mechanical counters operated by electro-magnets, the circuits through which are controlled by the perforated cards or ~~strips~~ strips."

When the returns containing the record of each person have been received from the enumerators of the census, each record is ~~trans~~ transcribed by punching, to a manilla card, $6\frac{1}{8}$ by 3 inches. These cards have one corner cut off diagonally to ensure proper arrangement of the cards when piled together. The number of the corresponding record having previously been written on the card for the purposes of identification. The state, enumerator's district etc. are recorded on the card by a certain combination of four or five holes at one end of the card reserved for that purpose. As this combination of holes will be the same for all ~~holes~~ the records from a given district, a special machine is arranged which ~~punches~~ punches all these holes through four or five cards at one operation, thus reducing the labor involved to a minimum. These holes serve positively to locate a card in its proper district. A card misplaced among a thousand, can be readily detected by the fact that one or more of these holes would not correspond with the balance of the

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cards. The importance of this consideration is manifest.

In order to punch the individual records upon the cards they are placed one by one in a ~~revolvable~~ suitable punching machine. This machine is arranged with a plate of metal pierced with numerous holes, each hole or combination of holes ~~corresponds~~ corresponding to some fact to be recorded; and the given record is transferred to the card by punching from it holes corresponding to the proper holes in the plate. The order in which the facts to be recorded are punched is in general conformity with that in the records, so that beginning at the left the card is punched for race, sex, age, relation to head of family, conjugal condition, occupation, education, physical condition, birthplace of father, ^{and} birthplace of mother. In this manner is obtained a complete record which will answer mechanically all questions which can be put to it. If desired, these punched record cards can easily be read and verified, by

1 simply placing them over printed forms
2 prepared for the purpose.

3 The tabulation of the facts thus recorded
4 on the cards is accomplished as described
5 below. The press shown in the diagram (7)
6 consists of a hard rubber bed plate provided
7 with suitable stops or guides against which
8 the cards are successively placed. The
9 bed plate is formed with a number of holes
10 or cups, corresponding in number and
11 arrangement with the holes that may be
12 punched on the card. Each cup is partly
13 filled with ~~vacuum~~ mercury and connected
14 with a binding post on the back of the
15 frame. Above the hard rubber plate is a
16 reciprocating box provided with a number
17 of projecting, spring-actuated, contact
18 points corresponding in position with the
19 centres of the mercury cups. When a card
20 is placed in the press, and the handle
21 brought down, these pins will form
22 circuits corresponding with the punched
23 record.

24 Arranged in a suitable frame are a
25 number of counters, each capable of (8)

1 registering to 10,000. These counters are
 2 actuated by electro-magnets terminating in
 3 binding posts on the back of the counter frame.

4 To tabulate any of the facts recorded on
 5 the cards, it is only necessary to connect the
 6 corresponding binding posts with the binding
 7 posts of the counters and then pass the cards
 8 through the press, when the results will be
 9 shown directly on the counters. The number
 10 of facts thus recorded at one operation is
 11 only limited by the number of counters
 12 which are used.

13 If, while ^{certain facts} ~~are~~ ^(being) thus tabulated ~~certain~~
 14 ~~facts~~, it is desirable at the same time to sort
 15 or arrange the cards according to any
 16 desired data, as for example nationality, a
 17 sorting box is employed. This box is suitably
 18 divided into twenty ^{four} compartments, each of
 19 which is closed by a lid, held against the
 20 tension of a spring, by a catch which forms
 21 the armature of a ~~set~~ suitable magnet.

22 If desired the number of compartments may be increased.
 23 These magnets, are connected with the
 24 binding posts of the press according to the
 25 data by which the cards are to be assorted.
 When ~~the~~ ^a card is put in the press the

armature, corresponding with the given record is attracted, thus releasing the corresponding lid, which remains open until the card is deposited in that division and the lid again closed by hand. This is done with the right hand while, with the left hand another card is being put in position in the press. The sides of the sorting box are hinged to permit the easy removal of the cards when assorted. The sorting of the cards can be done while at the same time ^{counting} any desired group or groups of facts. (10)

A series of checks upon the accuracy of the machine's record can easily be applied. (11)

- (a) In recording a given series of facts upon a number of dials one dial is always so connected that it will record every card that passes. The reading of this dial must therefore equal the sum of the readings of all the others. (b) Every time the circuit is closed in the act of registering the facts upon a card a bell strikes. The failure of this bell to sound is therefore a warning to the operator that for some reason the card has not been registered. ~~If by~~ (c) If

by accident a card is placed under the press upon which is recorded none of the facts at that time being enumerated the machine will refuse to register. (d) All the cards that rightly belong in any one of the ~~said~~ sorting boxes will have at least one hole in common (besides those denoting the district) and a piece of wire may be thrust through this hole if the cards are piled together in order. Inability to do this shows that one card has been placed in the wrong box and the intruder can be at once thrown out.

A commission appointed by the Superintendent of the Census instituted a comparison between three methods of compiling census returns; Mr Chas. F. Ridgier's method, called the "chip system", Mr W^m C. Hunt's method by means of ~~of~~ cards and tally sheets and the method of Mr Hollerich. The test ~~the~~ selected was the retabulation of ~~the returns of~~ certain returns from the Census of 1880 from four districts containing 10491 inhabitants. The following results are quoted from the commission's report.

Time Occupied in Transcribing

1	By punching, Hollerith's method ---	72 h. 27 min.
2	On Slips, Hunt's " "	144 h. 25 min.
3	On "chips", Pidgin's " "	110 h. 56 min.

4 Time occupied in tabulating.

5 By electrical machine; Hollerith's method --- 5 h. 28 min.

6 By sorting slips, Hunt's method --- 55 h. 22 min.

7 By sorting "chips" Pidgin's method --- 44 h. 41 min.

8 The commission further report that Hollerith's
9 method of tabulating is superior to both the
10 others in accuracy. They estimate that its use in
11 compiling the 8th returns of the eleventh census will
12 result in a saving of \$579,125.00, about 25%
13 of the total cost of taking the tenth census.

14 Your subcommittee made an examination of the
15 Hollerith system in Washington, where they saw it
16 in operation, and they are of the opinion that it
17 is invaluable ^{wherever} ~~where~~ large numbers of individual
18 facts are to be summed and tabulated. They
19 consider that the inventor is deserving of the
20 greatest ^{commendation} ~~credit~~, for this useful and novel
21 application of electricity and strongly recommend
22 that he be ^{granted} ~~awarded~~ for his invention the
23 highest award in the gift of the Franklin
24 Institute.

L. d'Auria Chairman
Francis Leclère
L. F. Rondinella
Edwin S. Crawley.